



Characterizing the New Jersey Farm Landscape

Case Studies of Urban Fringe Farm Footprints



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Study Team and Acknowledgments

Study Team

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Most importantly, the team sincerely thanks the farmer participants in this study for access to their farms.

Project Goal

This project was commissioned by the State Agriculture Development Committee to understand and characterize the contemporary New Jersey farm landscape, with specific intent to measure the extent and nature of built structures and improvements that result in soil disturbance on commercial farms in various sectors of the industry.

Information generated from this study will be useful in ascertaining the extent to which on-farm improvements (notably those modifying soil permeability or structure) are required to support the diversity of commercial farming activities occurring in the state. Such information will be useful in informing current and future policy discussions concerning soil disturbance on farms, interpretations of deed of easement conformity, and new and entering farmers of the nature and extent of agricultural infrastructure required by modern farm operations.

Current Policy Context

Policies establishing impervious cover limits on farm properties have emerged as an important issue within the New Jersey farming industry. Impervious cover limits have become prominent discussion points in the context of efforts to protect soil and water resources.

There are several statutory or regulatory drivers to these discussions, including:

- Highlands Water Protection and Planning Act,
- New Jersey Department of Environmental Protection's Stormwater Management Rules,
- Amendments to the Garden State Preservation Act authorized in 2002 to protect water resources, and
- United States Department of Agriculture's Farm and Ranch Lands Protection Program.

The SADC is attempting to collectively address these statutes and regulations (see program details in Appendix A), which all limit or have certain requirements related to impervious cover.

Current Policy Context

(continued)

Impervious cover and soil disturbance discussions are also increasingly prominent within the context of farmland preservation. Farms enrolled in the State's Farmland Preservation Program must conform to terms specified in a deed of easement. These deeds (1) allow farmland owners to construct improvements for agricultural purposes and (2) prohibit activities detrimental to drainage, flood control, water conservation, erosion control, or soil conservation. In short, no activity may be conducted on preserved farmland that would impair continued agricultural use of the property.

The SADC is seeking to clarify these two deed of easement provisions so that it may provide clear guidance to landowners, county agriculture development boards, and other preservation partners on the permissible type and extent of soil disturbance and construction of agricultural improvements on preserved farmland.

Field Research - Approach and Methods

Case studies were developed for ten (10) New Jersey farms. Farm selection was based on a non-random, purposive sampling approach to provide variability in scale of operation (e.g., acreage), type of primary farming activity, land tenure (e.g., leasing versus ownership), and land preservation status.

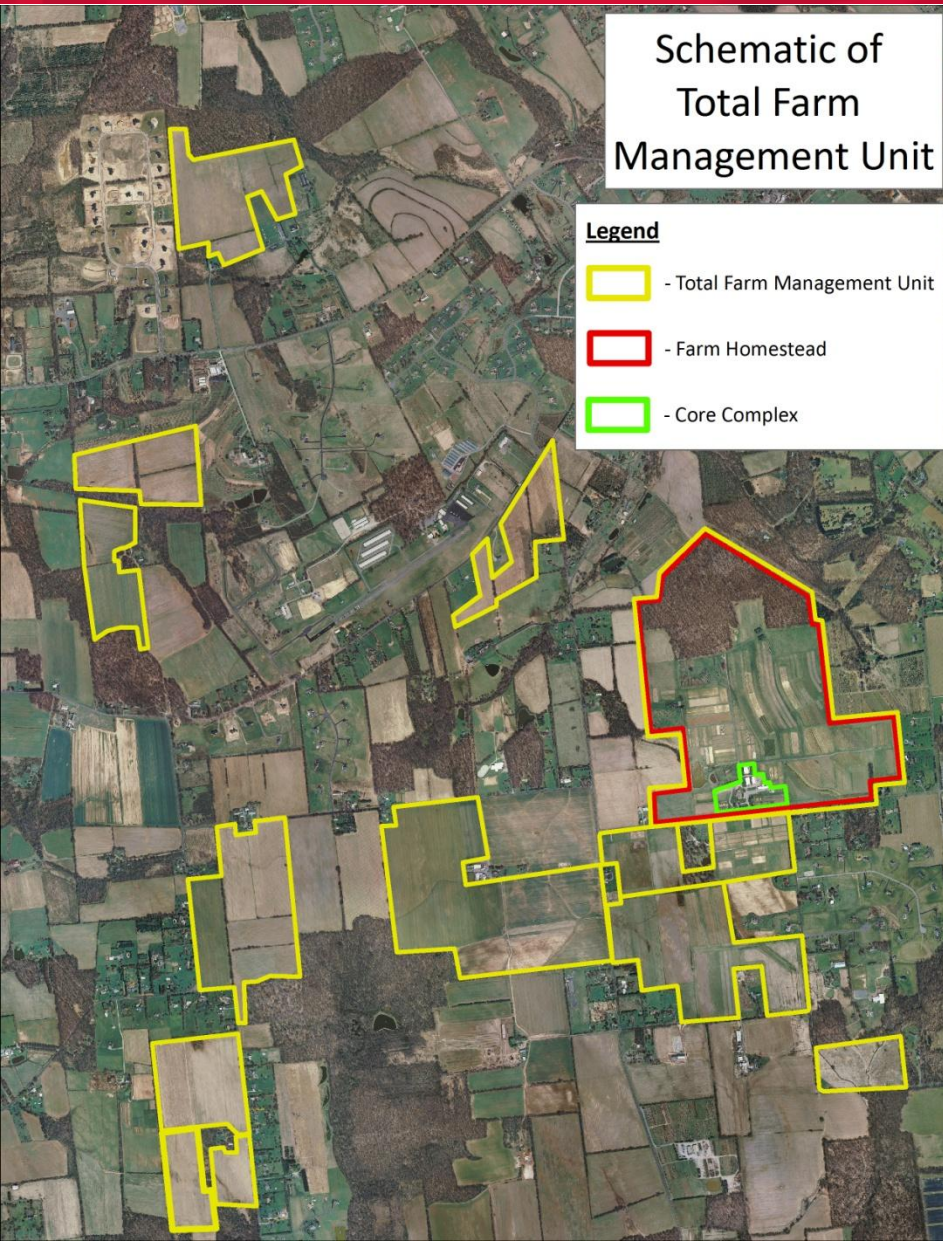
The study team selected a specific cohort of farms that, *a priori*, were expected to rely on significant levels of built infrastructure or attendant farm landscape modifications. For example, four (4) farm enterprises involved varying forms of on-farm direct marketing and agritourism. Similarly, five (5) wholesale greenhouse or nursery operations were selected given the nature and extent of specialized infrastructure investments and associated landscape modifications frequently associated with these enterprises.

The identification of case study farms was facilitated through consultation with Rutgers Cooperative Extension county agricultural agents.

Field Research - Approach and Methods

(continued)

Informed consent forms were completed by each farmer, allowing researcher access to the farm and the collection of data on farm landscape characteristics. Farmer participants were assured that summary data on farm location, activities, and physical characteristics would be presented in a manner that would maintain anonymity.



Framing the Analysis

Farmers commonly operate multiple, non-contiguous properties. This is prevalent in land-extensive farming sectors, such as field crops or certain types of vegetable production.

This study focused on what each farmer participant identified as their primary **Farm Homestead** property, defined generally as the base of operation for the overall **Total Farm Management Unit**. In these case studies, the farm homestead is frequently also the site of the farm residence. Within each Farm Homestead, a **Core Complex** was also defined as the area containing the majority of farm improvements.

Defining the Farm Homestead

Tax maps were reviewed to verify the acreage of each Farm Homestead. Data on the total acreage operated was self-reported by participating farmers and recorded to place the Farm Homestead in the context of the entire Farm Management Unit.

New Jersey 2007-2008 High Resolution Orthophotography tiles were compiled for each case study farm from the New Jersey Office of Information Technology, Office of Geographic Information Systems.* The orthophotography was produced at a scale of 1:2400 (1"=200') with a 1 foot pixel resolution.

*Digital orthophotography is a process which converts a digitized perspective aerial photograph or other remotely sensed image data to a digital product that has been rectified for camera lens distortion, vertical displacement caused by terrain relief and variations in aircraft altitude and orientation.

Categorizing Farm Landscape Modifications

Using ArcGIS 9.3, boundaries were digitally drawn around each discernible farm structure or land use attribute. Descriptive data were recorded for each resulting boundary, or “polygon feature.”

Mapped attributes were validated during site visits, and modified as necessary. Any new structures or land use features (e.g., those post-dating the orthophotography imagery) were similarly recorded and appended to the GIS shape file(s). The area of each polygon was then calculated.

Categorizing Farm Landscape Modifications

Polygon features were classified into one of nine landscape modification categories:

- (1) **Permanent Improvement – Concrete Floor** (*e.g., barn, slab, residence*)
- (2) **Permanent Improvement – Dirt/Gravel Floor** (*e.g., pole building, shed*)
- (3) **Temporary/Moveable Improvement** (*e.g., hoop greenhouse, storage tank*)
- (4) **Production Area** (*e.g., field, pasture, orchard*)
- (5) **Equipment Movement Area – Gravel/Paved** (*e.g., driveway, lane, parking, loading*)
- (6) **Equipment Movement Area – Dirt** (*e.g., driveway, lane, parking, loading*)
- (7) **Lawn or Buffer** (*e.g., residential lawn, hedgerow*)
- (8) **Pond or Drainage** (*e.g., irrigation pond, terrace, ditch, grass swale*)
- (9) **Appurtenant Land** (*e.g., wooded area, wetland corridor*)

Intensive focus was placed on mapping the portions of each Farm Homestead actively managed or supporting agricultural production. Features of associated appurtenant lands outside of active agricultural production (*e.g., stream corridors, wetlands, forested land*) were not individually detailed.

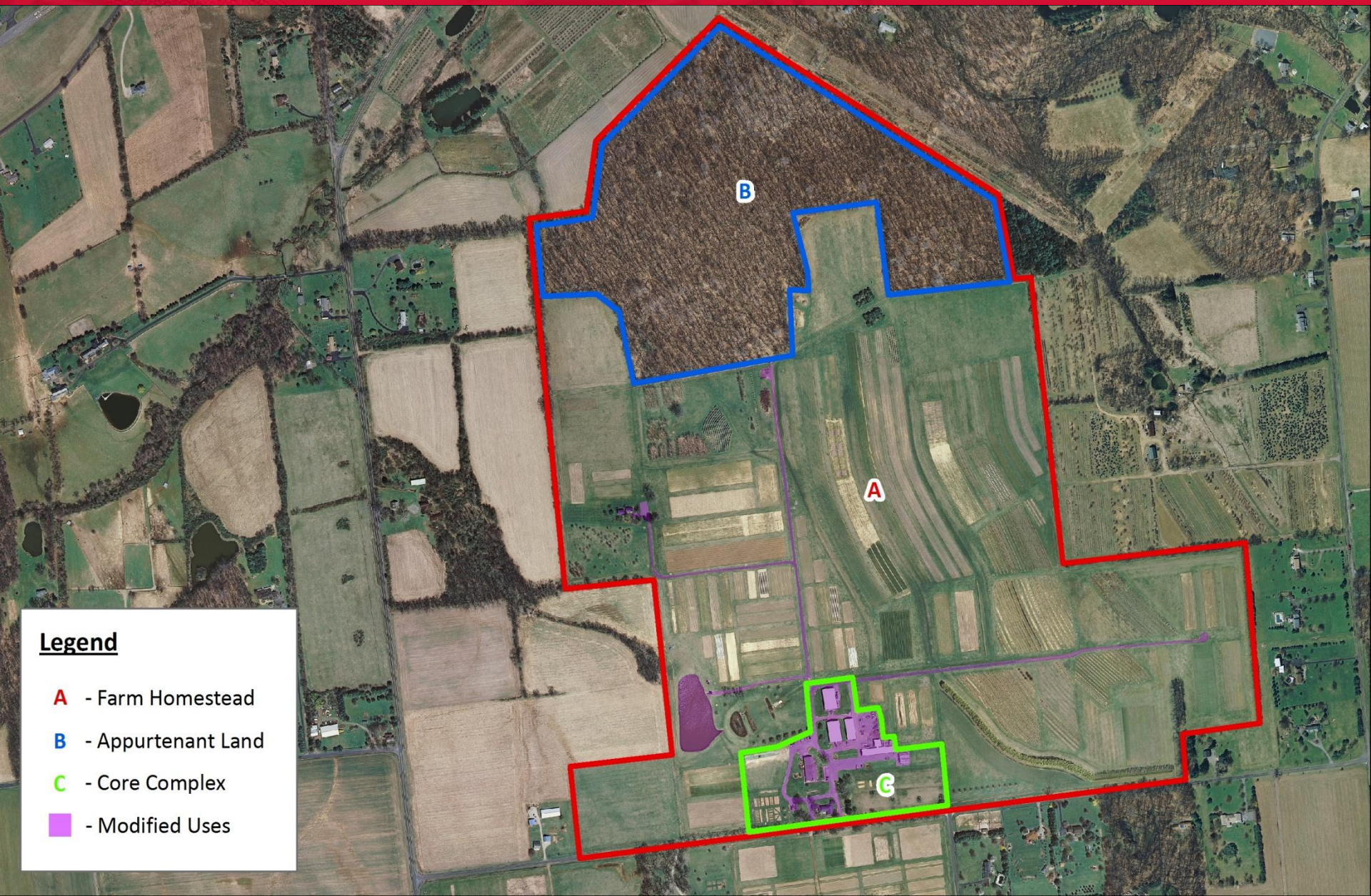
Categorizing Farm Landscape Modifications

For purposes of presentation, several landscape modifications are condensed into “**Modified Uses**” to reflect physical modifications made to the farm landscape to support agricultural production.* Such classification does not define the presence or extent of surface imperviousness.

Modified Uses are defined to include the following farm landscape modifications:

- Permanent Improvement– Concrete Floor
- Permanent Improvement – Dirt/Gravel Floor
- Temporary/Moveable Improvement
- Equipment Movement Area – Gravel/Paved
- Equipment Movement Area – Dirt
- Pond or Drainage.

* The study team acknowledges that agriculture is a disturbed ecology and a modification of the natural landscape.



Legend

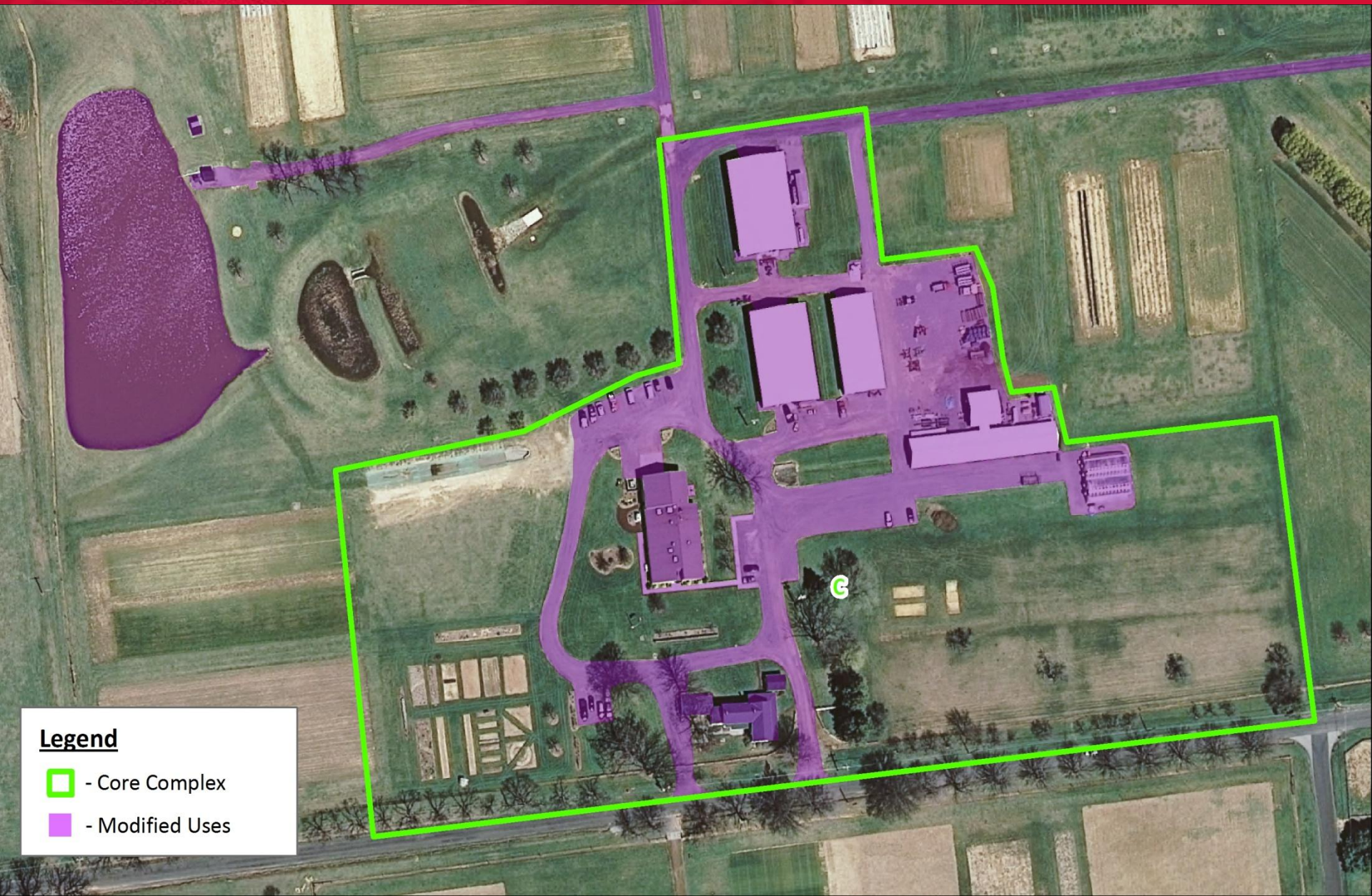
- A** - Farm Homestead
- B** - Appurtenant Land
- C** - Core Complex
- - Modified Uses

Defining the “Core Complex”

Many farm operations have a discernible "core" area where structures have been built and other improvements have been made. Observing that farm infrastructure and attendant land use modifications on most farms is often spatially concentrated, the study team delineated an area within each Farm Homestead as the “**Core Complex**.” In contrast, the balance of the Farm Homestead may be viewed as the portion of the farm that would have value for agricultural production in a farm sale or lease agreement.

While not a technical definition, the Core Complex was determined via orthophotography imagery and “boots-on-the-ground” validation as the area encompassing the most significant concentration of modified uses (see Area C, in Slides 13 and 15). This designation is intended only to help present the extent to which modified uses are spatially concentrated on farms. The schematics in Slides 13 and 15, and subsequent analysis of case study farms, show that modified uses often exist outside of the Core Complex.

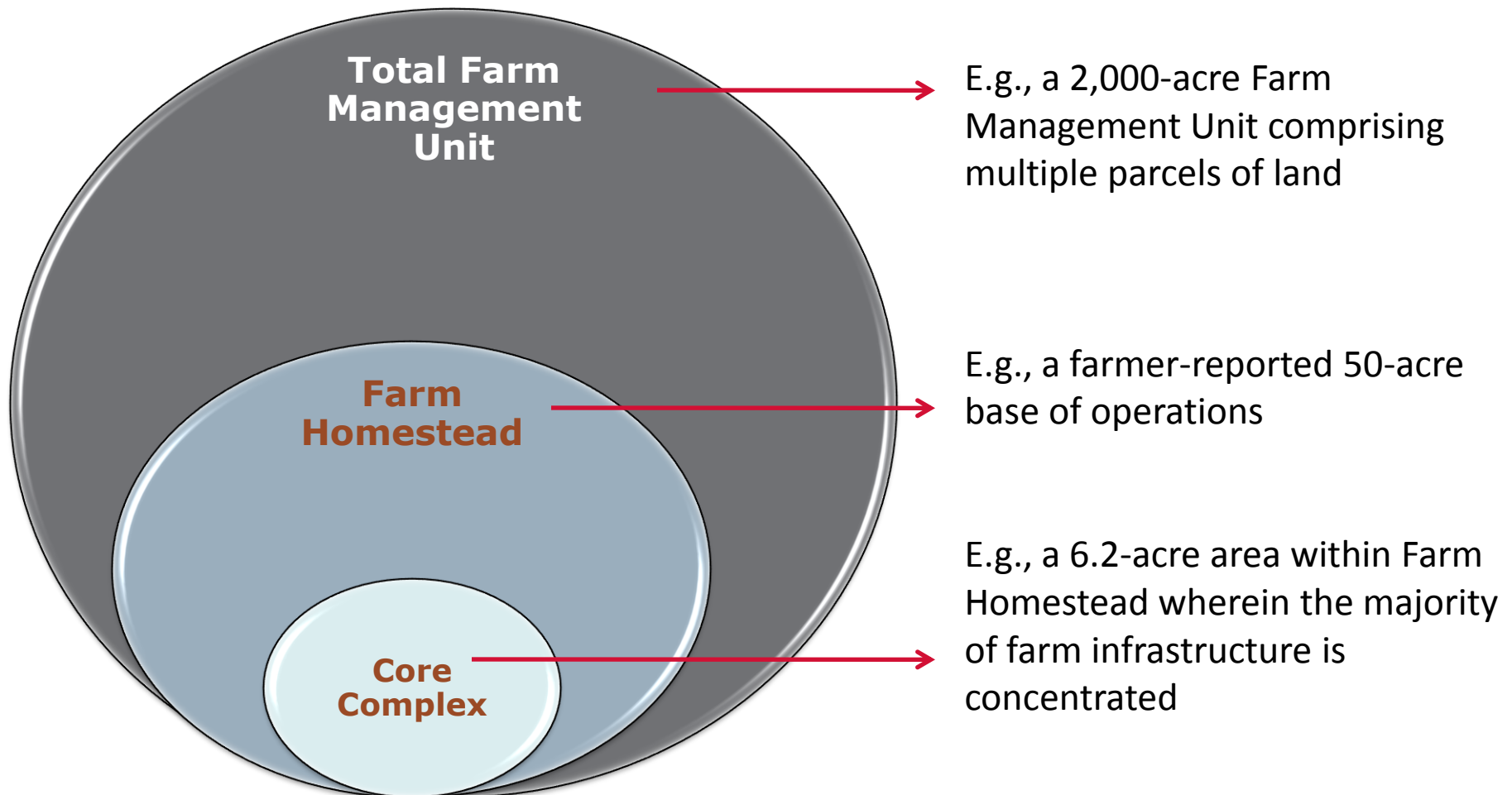
To more accurately depict the spatial distribution of farm infrastructure, data on landscape modifications were therefore analyzed for the (1) Farm Homestead, and (2) Core Complex.



Legend

- - Core Complex
- - Modified Uses

Schematic of Units of Analysis



Summary of Case Study Farms

Farm Operation	Total Farm Management Unit (acres)	Rented Land?	Preserved Land?	Farm Homestead Acreage
1 – Field Crops	500+	Y	Y	54.9
2 - Vegetable, Fruit; Direct Marketing	100-500	Y	Y	53.0
3 – Wholesale Nursery	100-500	Y	Y	96.5
4 - Wholesale Greenhouse	<50	Y	Y	43.1
5 - Vegetable, Fruit, Small Livestock; Direct Marketing	50-100	N	Y	53.4
6 - Small Livestock; Direct Marketing	100-500	N	N	115.3
7 - Vegetable, Fruit; Direct Marketing	100-500	Y	Y	36.5
8 - Wholesale Nursery	50-100	N	N	20.0
9 - Wholesale Nursery	100-500	N	Y	51.0
10 - Wholesale Nursery	250-500	N	N	231.1

Farm Case Study 1

A large field crop operation

Enterprise Overview

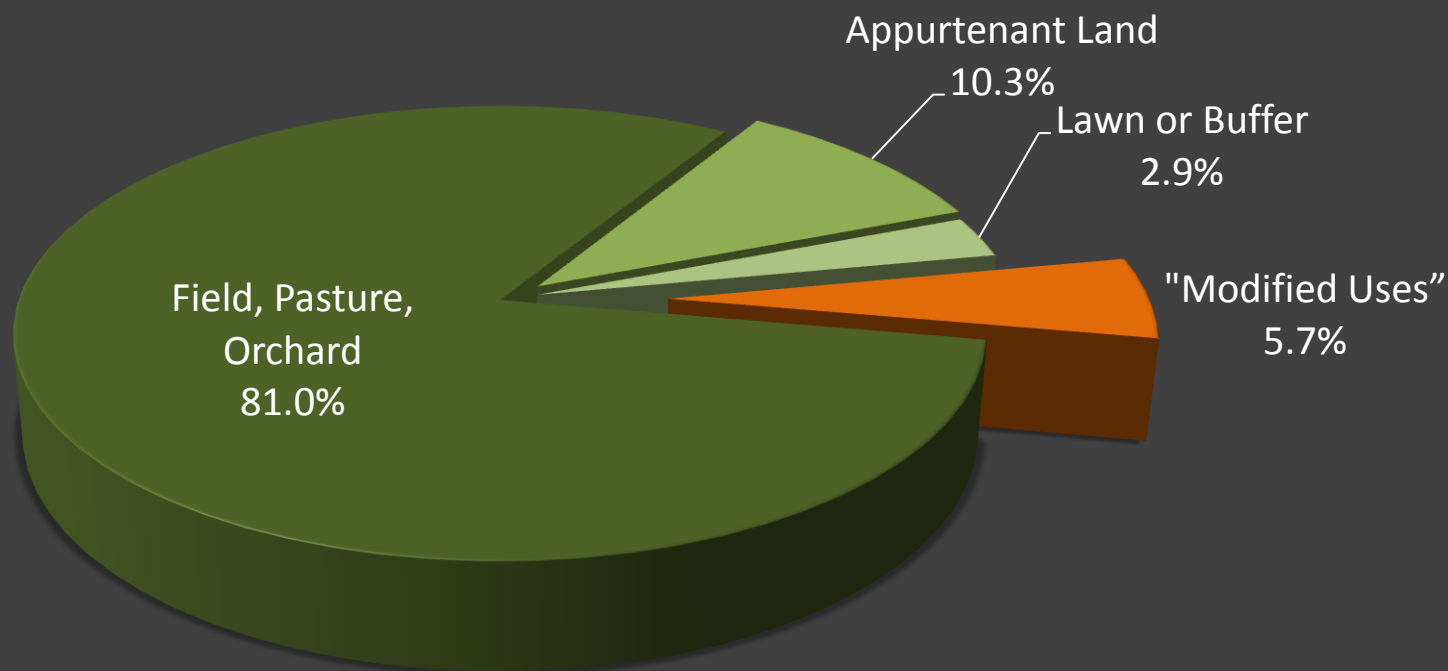
Farm 1 is a large (500+ acre) farm primarily engaged in field crop production. The farmer operates multiple, non-contiguous properties spanning several municipalities. The large majority of acreage is leased. Roughly 29 percent of the total farmed acreage is under farmland preservation. Analysis was focused on the approximately 55 acre Farm Homestead.

Farm Case Study 1

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	44.4	81.0
	Appurtenant Land	5.7	10.3
	Lawn or Buffer	1.6	2.9
Modified Uses <u>Sub-Total</u> 3.1 acres 5.7% of Farm Homestead	Permanent Improvement– Concrete Floor	0.5	0.9
	Permanent Improvement– Dirt/Gravel Floor	<0.1	0.1
	Temporary/Moveable Improvement	<0.1	0.1
	Equipment Movement Area – Gravel/Paved	2.2	4.1
	Equipment Movement Area – Dirt	0.2	0.4
	Pond or Drainage	0.1	0.3
	Farm Homestead Total	54.9 acres	100.0%

Farm Homestead Composition - Case Study 1 (Field Crops Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 1 include:

- A primary residence (farm family)
- Several barns with dirt, gravel and/or concrete floors
- Several grain silos on concrete slabs and related grain handling infrastructure
- Several moveable storage tanks (fertilizer, fuel, water)
- A pesticide shed
- Several small storage sheds and moveable storage containers
- A central driveway leading into an area of packed gravel constituting the primary farm yard
- Dirt farm lanes around grain fields
- A runoff ditch in one of the primary fields.

Nearly all identified farm infrastructure is located within a 4.6 acre Core Complex delineated by the research team. The complex is primarily defined as the central yard containing large field crop and equipment storage structures and the farm residence (see Appendix C for details).

Farm Case Study 2

A large fruit and vegetable operation

Enterprise Overview

Farm 2 is a large (100+ acre) preserved farm engaged in the production of fruit and vegetable crops. Roughly 80 percent of the farmed land is owned by the principal operator. The farm management unit comprises multiple parcels in close proximity. The farm is actively engaged in direct marketing of farm products and on-farm agritourism. Analysis is focused on the approximately 53 acre Farm Homestead.

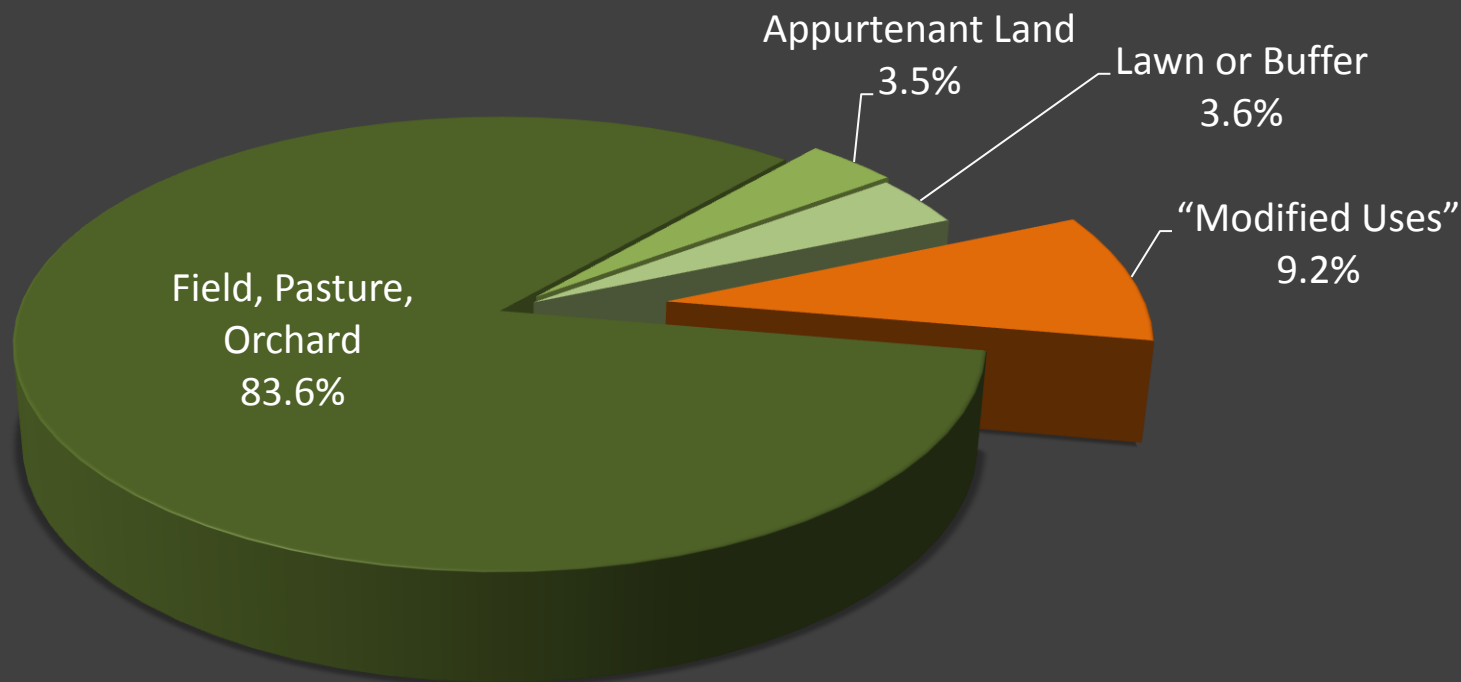
Farm Case Study 2

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	44.3	83.6
	Appurtenant Land	1.9	3.5
	Lawn or Buffer	1.9	3.6
Modified Uses <u>Sub-Total</u> 4.9 acres 9.2% of Farm Homestead	Permanent Improvement– Concrete Floor	0.7	1.2
	Permanent Improvement– Dirt/Gravel Floor	0.1	0.1
	Temporary/Moveable Improvement	<0.1	<0.1
	Equipment Movement Area – Gravel/Paved	3.3	6.2
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	0.9	1.7
	Farm Homestead Total	53.0 acres	100.0%

Farm Homestead Composition - Case Study 2

(53.0 acre Fruit and Vegetable Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 2 include:

- A primary residence (farm family)
- A permanent (year-round) farm market
- Several barns with dirt and/or concrete floors
- Two permanent greenhouses with concrete floors
- Driveways (gravel and/or millings) and gravel parking area for market
- Several small storage sheds and storage tanks
- Stalls for small livestock and equine animals
- Deer fencing around perimeter of farm.

The majority of farm infrastructure is located within a 4.8 acre Core Complex delineated by the research team. The complex is defined as the yard area leading to and comprising the farm market, farm residence, and barns (see Appendix C for details).

Farm Case Study 3

A large wholesale nursery operation

Enterprise Overview

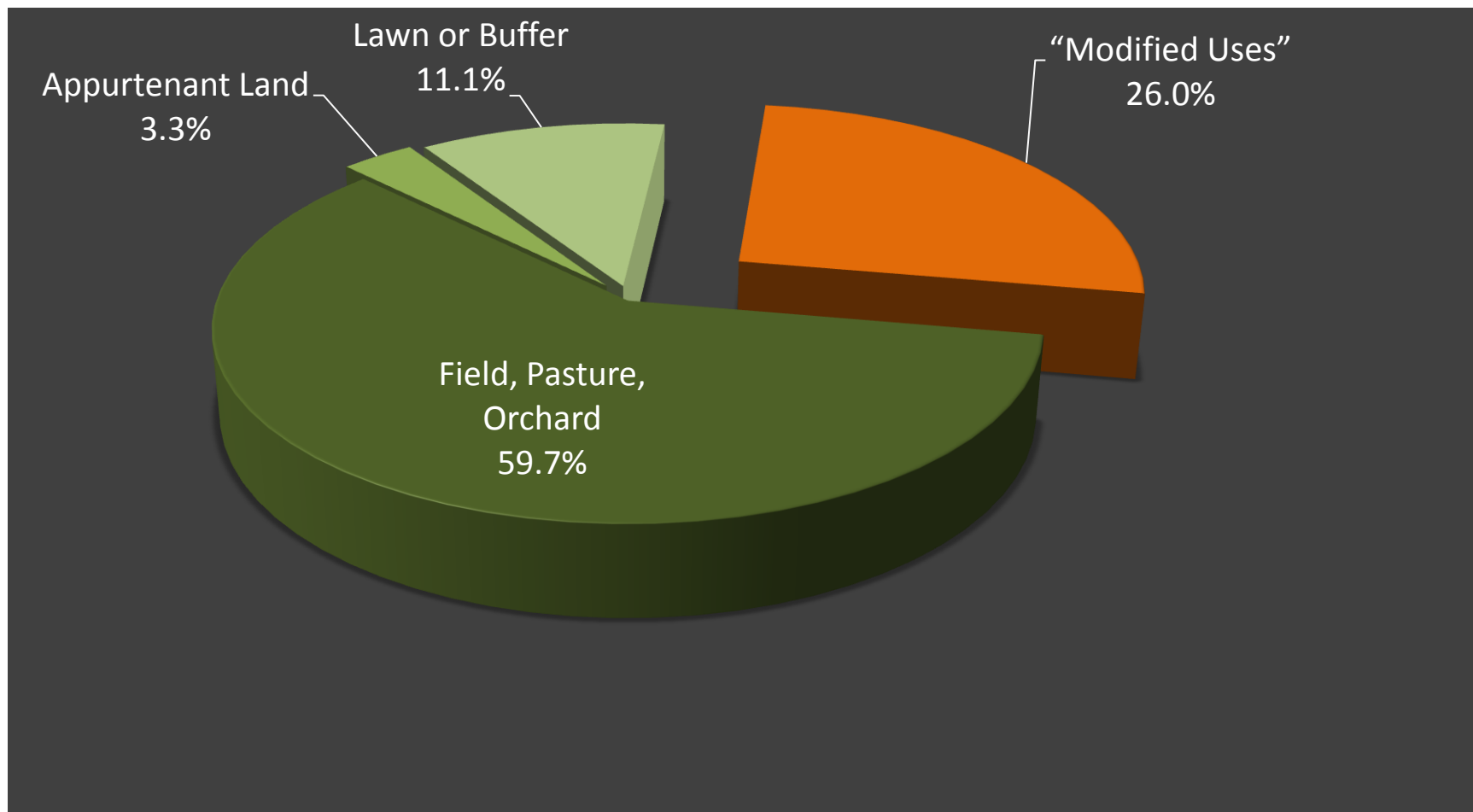
Farm 3 is a large (100+ acre) wholesale nursery specializing in the production of container plants, ball & burlap shrubs, and vegetables. Three-quarters of the farmed land is owned by the operator. The farmer operates on multiple contiguous parcels. Nearly all of the land is protected under farmland preservation. Analysis is focused on the approximately 96 acre Farm Homestead.

Farm Case Study 3

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	57.6	59.7
	Appurtenant Land	3.2	3.3
	Lawn or Buffer	10.7	11.1
Modified Uses <u>Sub-Total</u> 25.0 acres 26.0% of Farm Homestead	Permanent Improvement– Concrete Floor	0.8	0.8
	Permanent Improvement– Dirt/Gravel Floor	<0.1	<0.1
	Temporary/Moveable Improvement	7.7	8.0
	Equipment Movement Area – Gravel/Paved	3.0	3.1
	Equipment Movement Area – Dirt	12.3	12.7
	Pond or Drainage	1.3	1.3
	Farm Homestead Total	96.5 acres	100.0%

Farm Homestead Composition - Case Study 3 (96.5 acre Nursery Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 3 include:

- Two primary residences (farm family members)
- A large number of winter storage hoop houses (nearly 100 structures over 7.5 acres)
- Several barns (with concrete floors)
- A loading dock
- A pump house
- A small number of permanent greenhouses (with concrete floors)
- Several storage sheds and storage trailers (one trailer is used for office space)
- Driveways, parking areas, and lanes between hoop houses.

The majority of farm infrastructure is located within an approximately 26 acre Core Complex delineated by the research team. The complex is largely defined as the area upon which hoop houses are constructed, associated loading and storage structures, and farm residences (see Appendix C for details).

Farm Case Study 4

A small wholesale greenhouse operation

Enterprise Overview

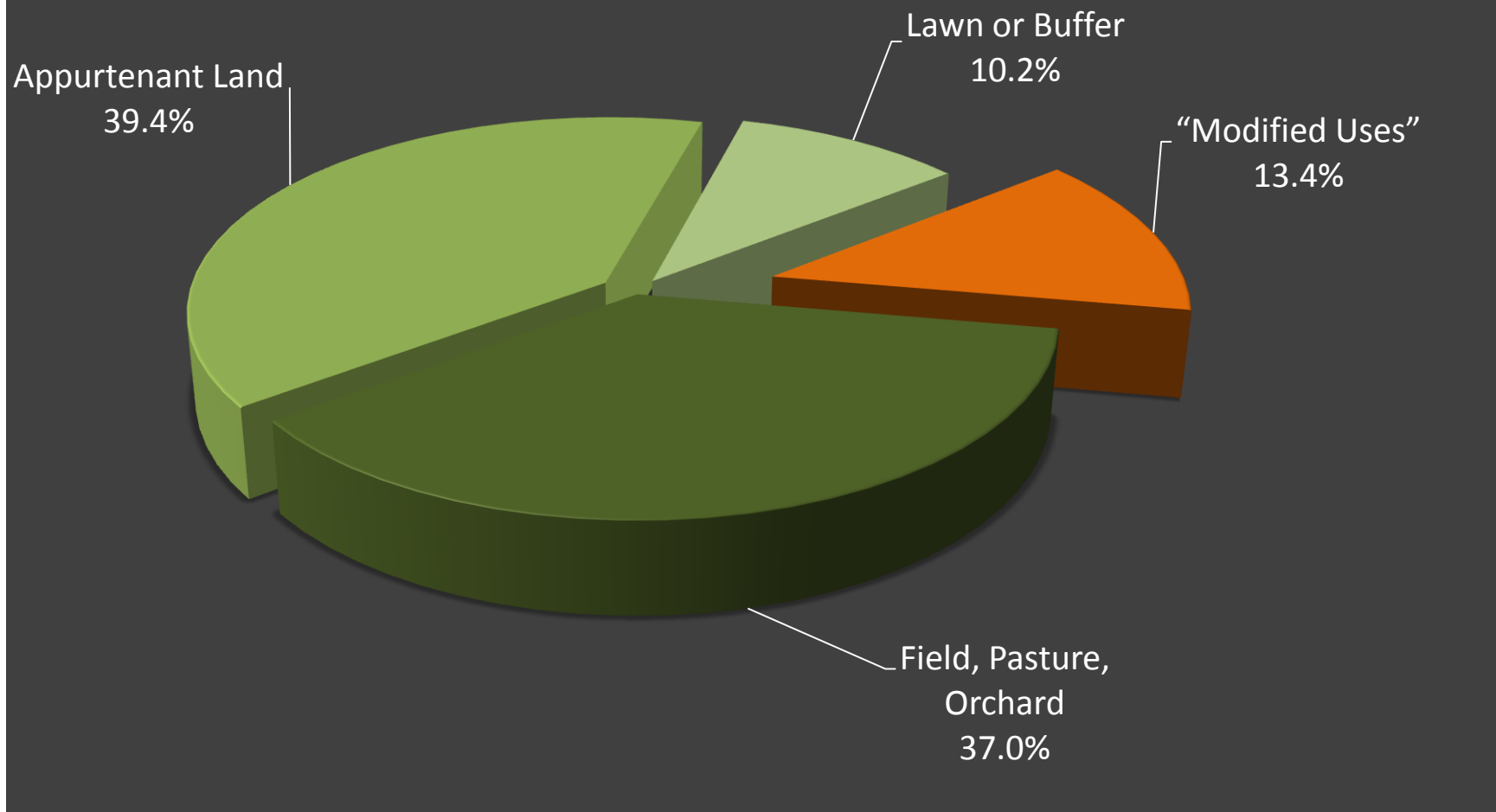
Farm 4 is a small (under 50 acre) wholesale greenhouse operation specializing in small container plant materials, florals, vegetables, and limited field production. Nearly all of the farmed land is owned by the operator; a small amount of additional greenhouse space is leased on an adjacent property. The entire owned portion of the operation is preserved. Analysis is focused on the approximately 43 acre Farm Homestead.

Farm Case Study 4

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	15.9	37.0
	Appurtenant Land	17.0	39.4
	Lawn or Buffer	4.4	10.2
Modified Uses <u>Sub-Total</u> 5.8 acres 13.4% of Farm Homestead	Permanent Improvement– Concrete Floor	3.5	8.1
	Permanent Improvement– Dirt/Gravel Floor	0.1	0.2
	Temporary/Moveable Improvement	<0.1	0.1
	Equipment Movement Area – Gravel/Paved	2.2	5.0
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	0.0	0.0
	Farm Homestead Total	43.1 acres	100.0%

Farm Homestead Composition - Case Study 4 (43.1 acre Greenhouse Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 4 include:

- Two primary farm residences and appurtenances (e.g., pool, gazebo)
- Several barns (with concrete floors)
- An office structure
- Several large complexes of permanent greenhouses (with concrete floors)
- Several storage sheds and storage tanks
- Driveways and parking areas.

The majority of farm infrastructure is located within an approximately 10 acre Core Complex delineated by the research team. The complex is defined as the area upon which permanent greenhouses, associated loading and storage structures, and farm residences are constructed (see Appendix C for details).

Farm Case Study 5

A mid-sized vegetable, fruit, and small livestock operation

Enterprise Overview

Farm 5 is a medium-sized (50+ acre) operation growing mixed vegetables and fruit and raising small livestock. All of the land is owned by the operator; more than 80 percent of the land is protected under farmland preservation. The farm spans two non-contiguous properties that are in close proximity. The farm is actively engaged in direct marketing of farm products and on-farm agritourism. Analysis is focused on the approximately 53 acre Farm Homestead.

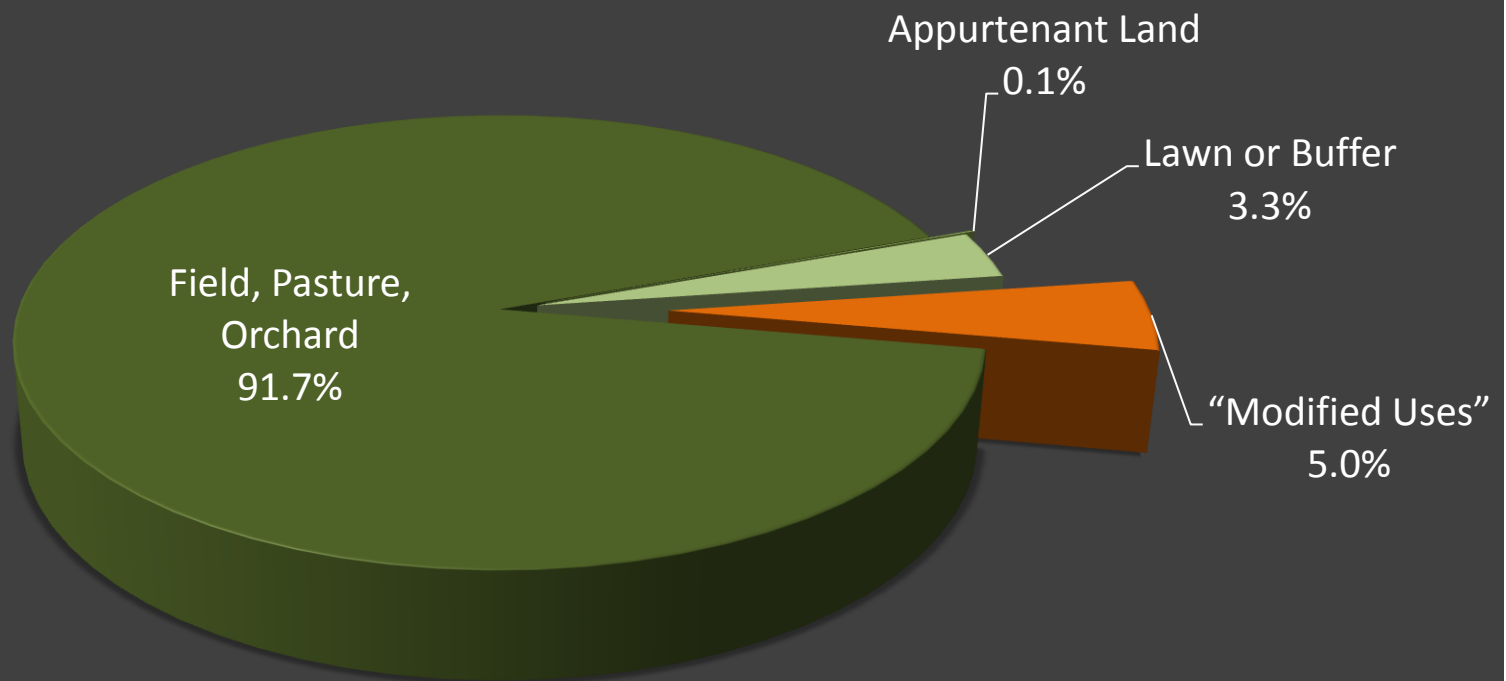
Farm Case Study 5

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	49.0	91.7
	Appurtenant Land	<0.1	0.1
	Lawn or Buffer	1.8	3.3
Modified Uses <u>Sub-Total</u> 2.6 acres 5.0% of Farm Homestead	Permanent Improvement– Concrete Floor	0.3	0.6
	Permanent Improvement– Dirt/Gravel Floor	0.7	1.4
	Temporary/Moveable Improvement	<0.1	0.1
	Equipment Movement Area – Gravel/Paved	0.7	1.3
	Equipment Movement Area – Dirt	0.6	1.2
	Pond or Drainage	0.2	0.5
	Farm Homestead Total	53.4 acres	100.0%

Farm Homestead Composition - Case Study 5

(53.4 acre Vegetable, Fruit and Small Livestock Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 5 include:

- Two primary farm residences
- Several barns (with dirt and/or concrete floors)
- A retail farm market
- Several small livestock containments
- Several storage sheds
- Deer fencing around the farm perimeter
- Driveways and parking areas.

The majority of farm infrastructure is located within an approximately 4 acre Core Complex delineated by the research team. The complex is defined as the area comprising the farm market and associated parking areas, the farm residences, animal shelters, and storage structures (see Appendix C for details).

Farm Case Study 6

A large small-livestock operation

Enterprise Overview

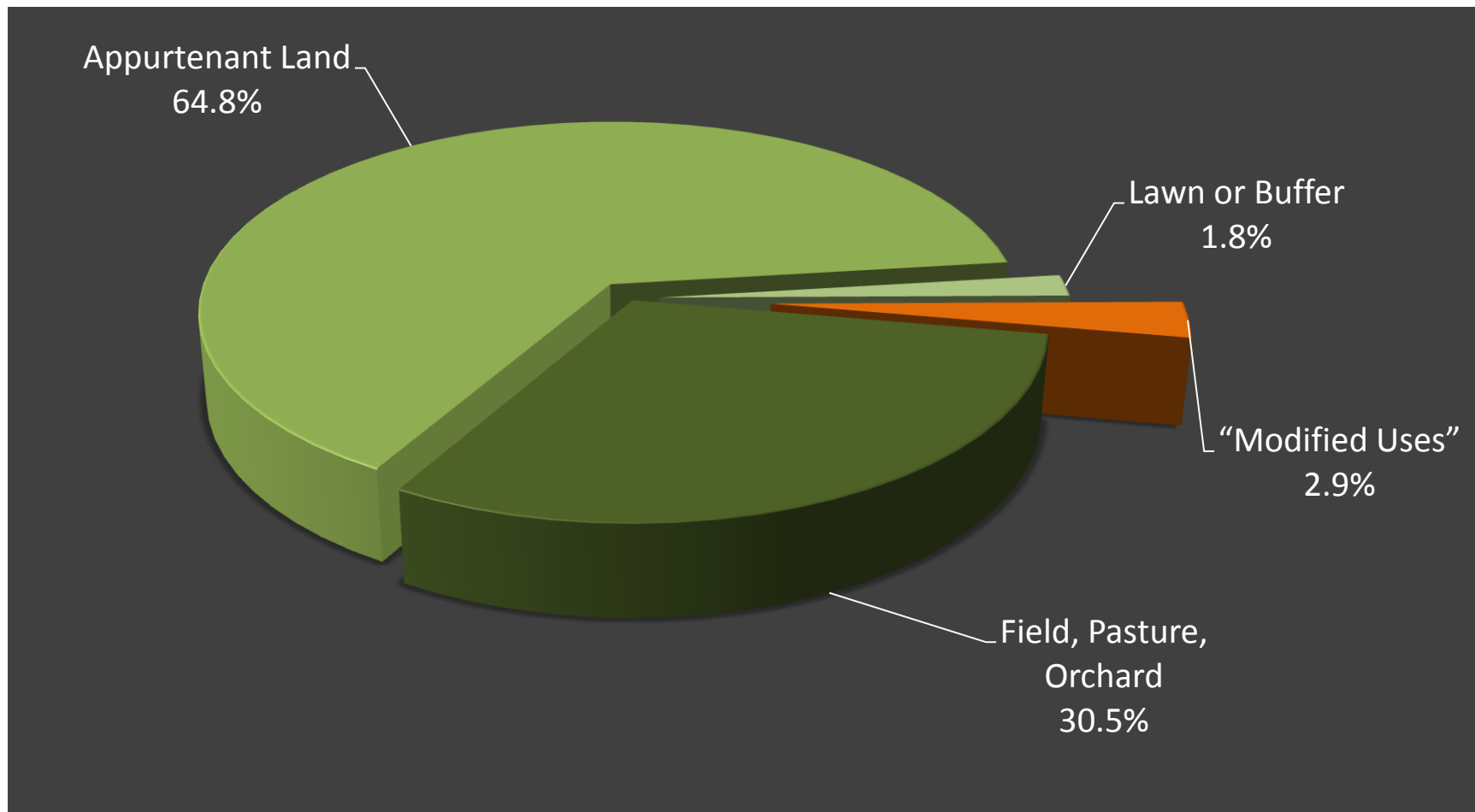
Farm 6 is a large (100+ acre) operation primarily engaged in small livestock production. All of the farmed land is one contiguous block owned by the operator, and is not enrolled in farmland preservation. The farm is engaged in direct marketing of farm products. Analysis is focused on the 115 acre Farm Homestead.

Farm Case Study 6

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	35.2	30.5
	Appurtenant Land	74.7	64.8
	Lawn or Buffer	2.0	1.8
Modified Uses <u>Sub-Total</u> 3.4 acres 2.9% of Farm Homestead	Permanent Improvement– Concrete Floor	0.9	0.8
	Permanent Improvement– Dirt/Gravel Floor	<0.1	<0.1
	Temporary/Moveable Improvement	0.3	0.3
	Equipment Movement Area – Gravel/Paved	2.2	1.9
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	<0.1	<0.1
	Farm Homestead Total	115.3 acres	100.0%

Farm Homestead Composition - Case Study 6 (115.3 acre Small Livestock Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 6 include:

- Several barns (with concrete floors)
- A structure for processing and storing farm products
- Cold-frame like structures used for livestock shelter
- Several livestock run-ins
- Several storage sheds
- Agricultural labor housing
- Gravel driveways and parking areas.

The majority of farm infrastructure is located within an approximately 8 acre Core Complex delineated by the research team. The complex is defined as the area comprising the central yard bordered by a large barn complex and other structures. A small pasture area surrounded by these structures is also encompassed in the core farm complex definition (see Appendix C for details).

Farm Case Study 7

A large vegetable and fruit operation

Enterprise Overview

Farm 7 is a large (100+ acre) operation growing mixed vegetables, fruits, and Christmas trees. The entire farmed acreage is preserved, and roughly one-third of the total farmed property is owned by the operator. The farm comprises multiple properties in close proximity. The farm is actively engaged in direct marketing of farm products and on-farm agritourism. Analysis is focused on the 36 acre Farm Homestead.

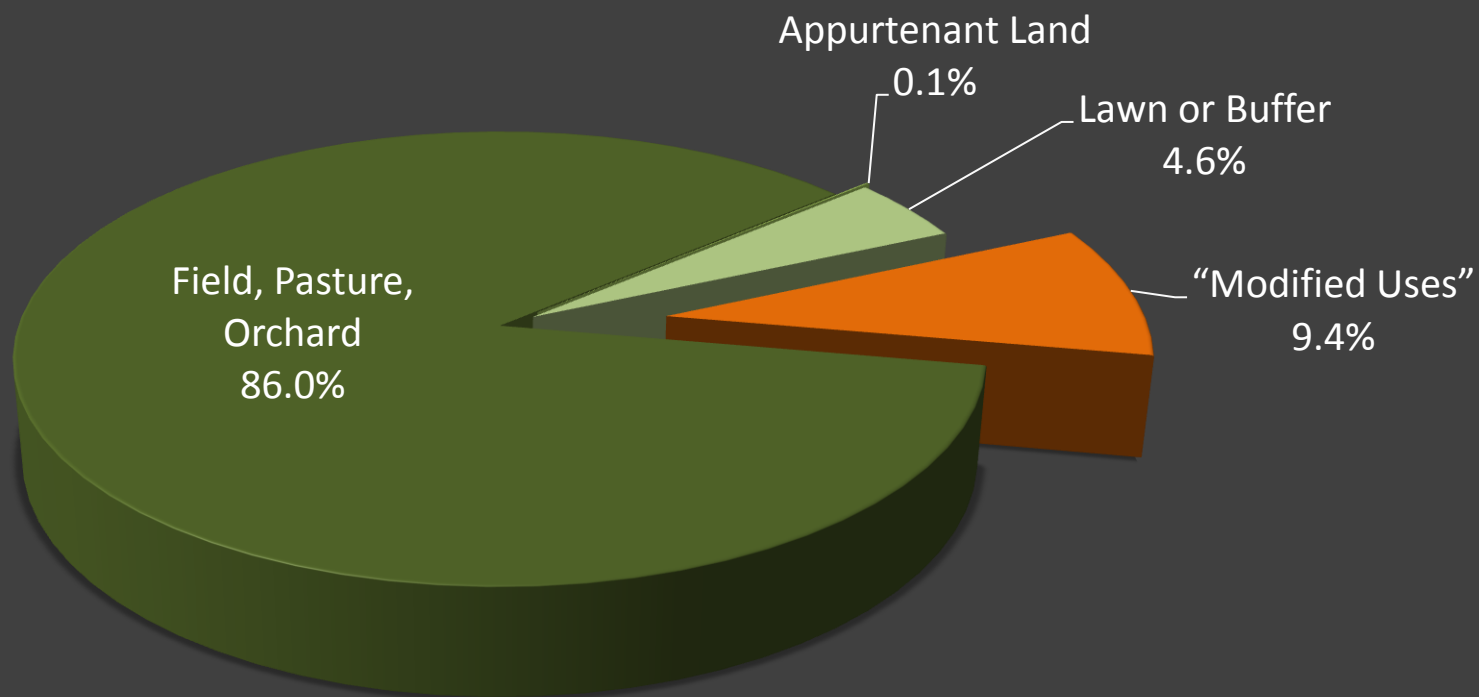
Farm Case Study 7

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	31.4	86.0
	Appurtenant Land	<0.1	0.1
	Lawn or Buffer	1.7	4.6
Modified Uses <u>Sub-Total</u> 3.4 acres 9.4% of Farm Homestead	Permanent Improvement– Concrete Floor	0.1	0.4
	Permanent Improvement– Dirt/Gravel Floor	<0.1	<0.1
	Temporary/Moveable Improvement	0.2	0.4
	Equipment Movement Area – Gravel/Paved	0.7	1.8
	Equipment Movement Area – Dirt	1.4	3.9
	Pond or Drainage	1.1	2.9
	Farm Homestead Total	36.5 acres	100.0%

Farm Homestead Composition - Case Study 7

(36.5 acre Vegetable and Fruit Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 7 include:

- Two farm residences
- Two permanent greenhouses
- A large barn complex with a farm market, with space for packing and storage
- Multiple sheds and refrigerated storage trailers
- Pole barn
- Several storage tanks
- Gravel and dirt driveways and parking areas.

The majority of farm infrastructure is located within an approximately 2 acre Core Complex delineated by the research team. The complex is defined as the area comprising the farm market and associated parking areas, the primary farm residence, and storage structures (see Appendix C for details).

Farm Case Study 8

A mid-sized wholesale nursery operation

Enterprise Overview

Farm 8 is a medium-sized (50+ acres) wholesale nursery operation specializing in container plants. The farm is not enrolled in farmland preservation and is entirely owned by the operator. The farm comprises multiple contiguous parcels. Analysis is focused on the 20 acre Farm Homestead.

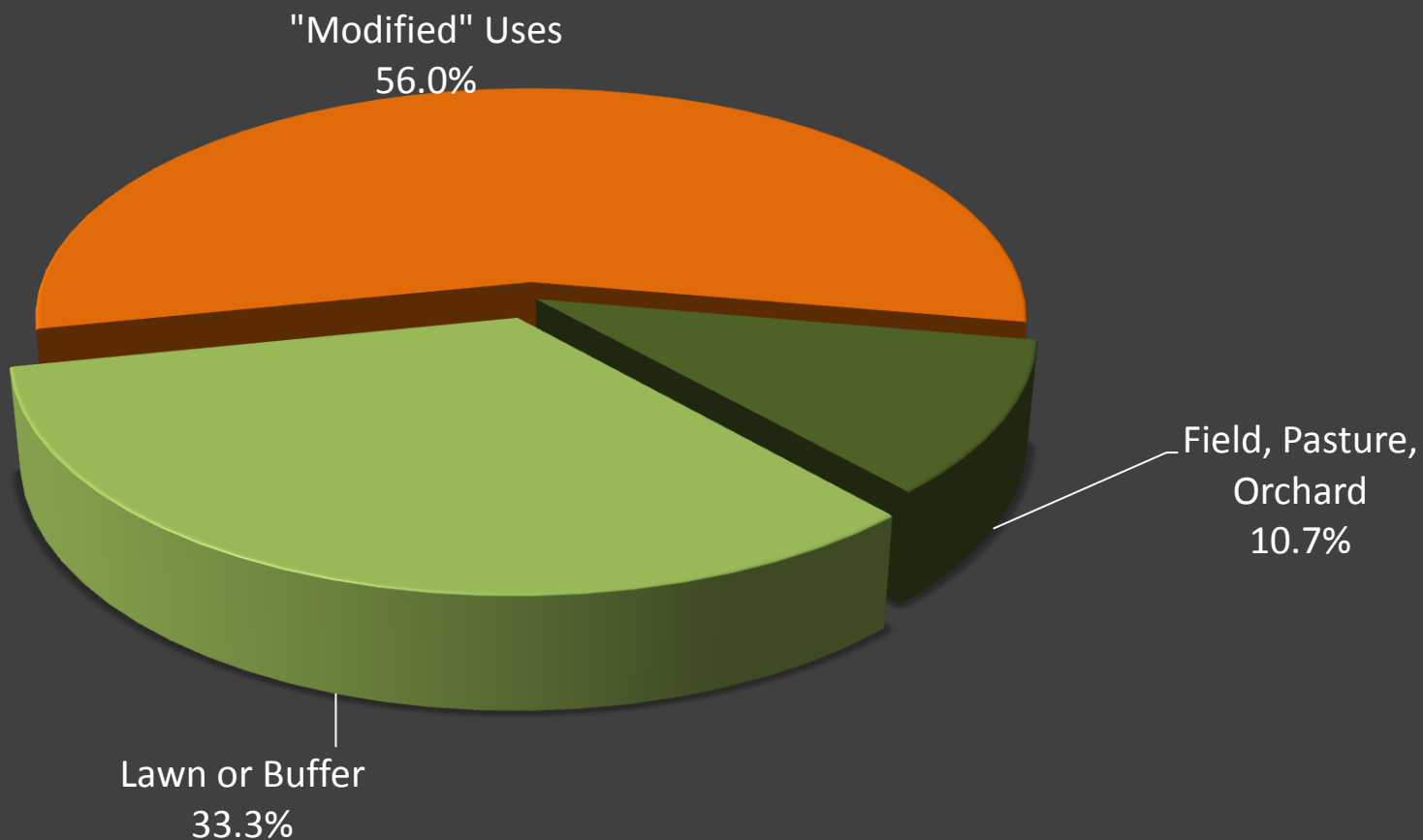
Farm Case Study 8

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	2.1	10.7
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	6.7	33.3
Modified Uses <u>Sub-Total</u> 11.2 acres 56.0% of Farm Homestead	Permanent Improvement– Concrete Floor	0.2	1.2
	Permanent Improvement– Dirt/Gravel Floor	0.0	0.0
	Temporary/Moveable Improvement	3.6	18.0
	Equipment Movement Area – Gravel/Paved	1.3	6.4
	Equipment Movement Area – Dirt	5.7	28.3
	Pond or Drainage	0.4	2.2
	Farm Homestead Total	20.0 acres	100.0%

Farm Homestead Composition - Case Study 8

(20.0 acre Wholesale Nursery Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 8 include:

- One primary farm residence
- A large number of winter storage hoop houses (more than 50 structures over 3.5 acres)
- Two barns (with concrete floors)
- Pesticide storage shed
- Tailwater recovery system, including a constructed impoundment for water reclamation
- Dirt/gravel driveways, parking areas, and lanes between hoop houses.

Farm infrastructure, mostly in the form of hoop houses, is a dominant element across most of this farm landscape. Given the extensiveness of the farm infrastructure across the operation, and the relatively small farm size, the research team defined the Core Complex to comprise the entire 20 acre Farm Homestead (see Appendix C for details).

Farm Case Study 9

A large wholesale nursery operation

Enterprise Overview

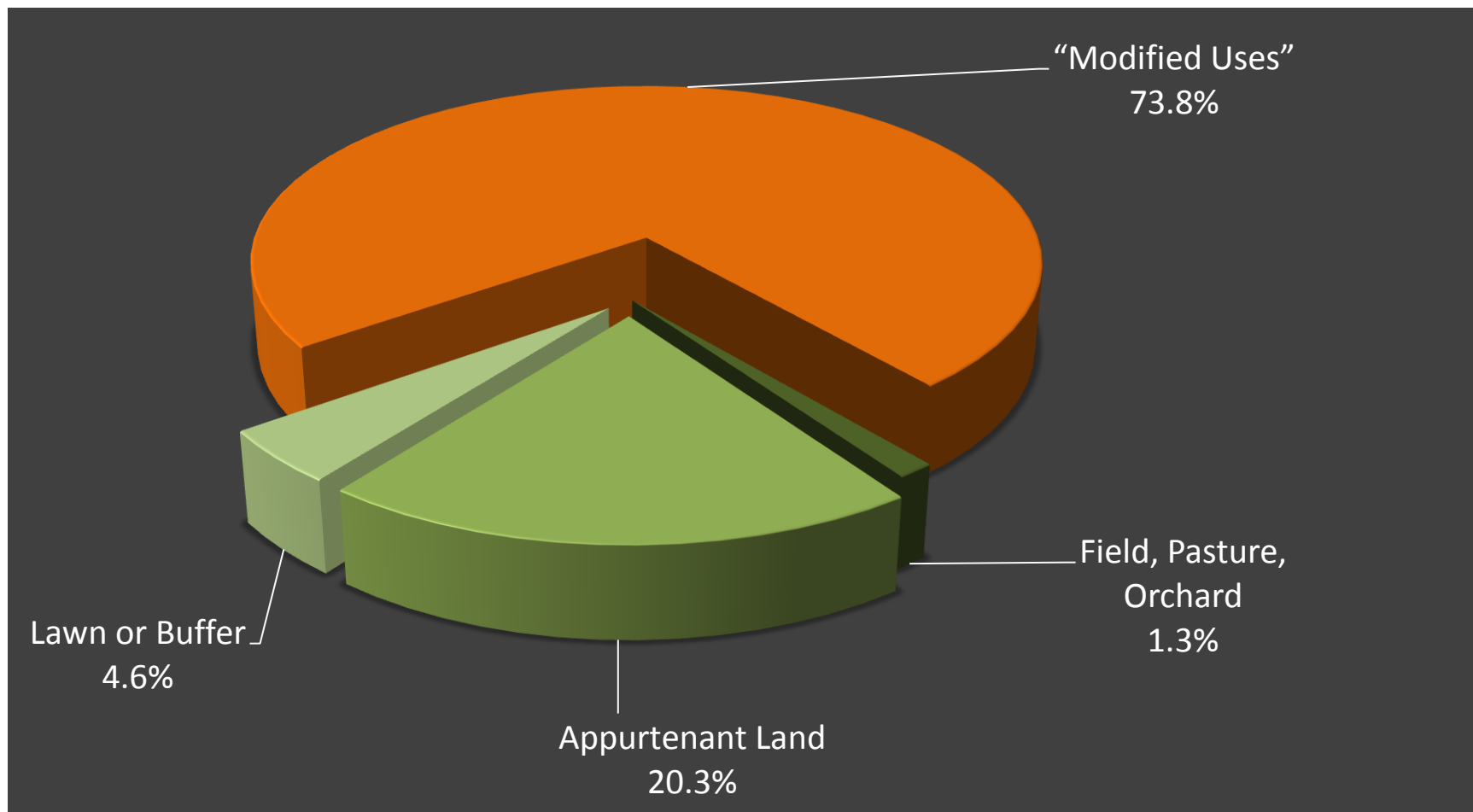
Farm 9 is a large (100+ acre) wholesale nursery specializing in container perennials and other nursery stock. The land is owned by the operator; more than 70 percent of the acreage is protected under farmland preservation. The farm spans multiple parcels in close proximity. Analysis is focused on the 51 acre Farm Homestead.

Farm Case Study 9

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.7	1.3
	Appurtenant Land	10.4	20.3
	Lawn or Buffer	2.3	4.6
Modified Uses <u>Sub-Total</u> 37.6 acres 73.8% of Farm Homestead	Permanent Improvement– Concrete Floor	0.8	1.6
	Permanent Improvement– Dirt/Gravel Floor	0.0	0.0
	Temporary/Moveable Improvement	15.7	30.7
	Equipment Movement Area – Gravel/Paved	1.6	3.2
	Equipment Movement Area – Dirt	19.5	38.3
	Pond or Drainage	0.0	0.0
	Farm Homestead Total	51.0 acres	100.0%

Farm Homestead Composition - Case Study 9 (51.0 acre Wholesale Nursery Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 9 include:

- Two farm residences and associated appurtenances (e.g., pool, garage)
- Heated propagation greenhouses (with concrete floors)
- Extensive winter storage hoop houses (covering more than 15 acres)
- Several barns for cold storage and equipment storage
- Primarily dirt (with some gravel) driveways, parking areas, and lanes between hoop houses.

Farm infrastructure, predominantly in the form of winter storage hoop houses, is a dominant element across most of this farm landscape. This infrastructure and associated landscape modifications are relatively uniform across the farm, except for three large blocks of appurtenant land (wooded areas) not used for production. The research team therefore defined a relatively large proportion of the Farm Homestead (nearly 41 acres) as the Core Complex (see Appendix C for details).

Farm Case Study 10

A large wholesale nursery operation

Enterprise Overview

Farm 10 is a large (100+ acre) wholesale nursery operation specializing in a combination of container and field-grown shrubs, trees and other perennial plant stock. The land is owned by the operator and is not enrolled under farmland preservation. The farm comprises multiple, non-contiguous parcels. Analysis is focused on the 231 acre Farm Homestead.

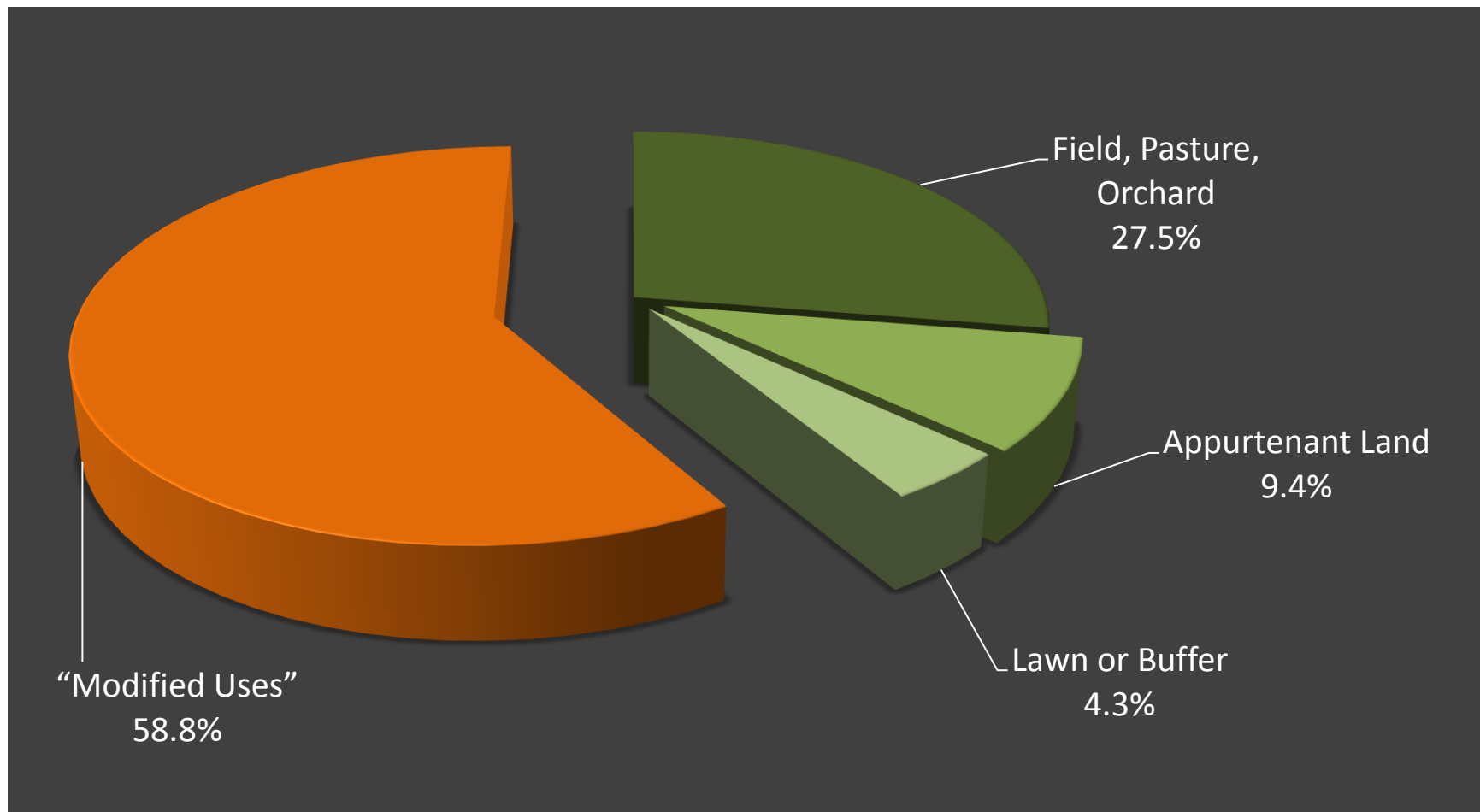
Farm Case Study 10

Farm Homestead Composition

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	63.6	27.5
	Appurtenant Land	21.6	9.4
	Lawn or Buffer	9.8	4.3
Modified Uses <u>Sub-Total</u> 136.0 acres 58.8% of Farm Homestead	Permanent Improvement– Concrete Floor	1.4	0.6
	Permanent Improvement– Dirt/Gravel Floor	0.9	0.4
	Temporary/Moveable Improvement	59.1	25.6
	Equipment Movement Area – Gravel/Paved	67.4	29.2
	Equipment Movement Area – Dirt	3.3	1.4
	Pond or Drainage	3.9	1.7
	Farm Homestead Total	231.1 acres	100.0%

Farm Homestead Composition - Case Study 10

(231.1 acre Wholesale Nursery Operation)



Description of Farm Infrastructure and Landscape Modifications

“Modified Uses” on Farm 10 include:

- One farm residence
- Extensive winter storage hoop houses (covering more than 59 acres)
- A large barn (with concrete floor)
- A complex of permanent greenhouses
- An office structure
- Two pump houses
- Multiple sheds
- Tailwater recovery system, including constructed impoundments for water reclamation
- Primarily gravel (with some dirt) driveways, parking areas, and lanes between hoop houses.

Farm infrastructure, predominantly in the form of winter storage hoop houses, is a dominant element across most of this farm landscape. This infrastructure and associated landscape modifications are relatively uniform across the farm, except for several areas of field production. The research team defined a large proportion of the Farm Homestead (159 acres) as the Core Complex (see Appendix C for details).

Summary of Farm Case Studies

Homestead Farm Composition

Case Study	Acres	Percent of Farm Homestead Acreage			
	Farm Homestead	Production Area	Appurtenant Land	Lawn & Buffer	Modified Uses Sub-Total
Farm 1	54.9	81.0%	10.3%	2.9%	5.7%
Farm 2	53.0	83.6	3.5	3.6	9.2
Farm 3	96.5	59.7	3.3	11.1	26.0
Farm 4	43.1	37.0	39.4	10.2	13.4
Farm 5	53.4	91.7	0.1	3.3	5.0
Farm 6	115.3	30.5	64.8	1.8	2.9
Farm 7	36.5	86.0	0.1	4.6	9.4
Farm 8	20.0	10.7	0.0	33.3	56.0
Farm 9	51.0	1.3	20.3	4.6	73.8
Farm 10	231.1	27.5	9.4	4.3	58.8
Range	20.0 - 231.1 ac	1.3 - 91.7%	0.0 – 64.8%	1.8 – 33.3%	2.9 – 73.8%

Summary of Farm Case Studies (continued)

An observation common across most Case Study Farms is that “vertical modifications” to the farm landscape (e.g., built structures) generally comprise considerably less area than modifications associated with parking and equipment movement, or other “horizontal modifications.”

Case Study	Farm Homestead (acres)	Modified Uses Subtotal (acres)	Acres (% of modified uses subtotal)	
			Horizontal Modified Uses (Equipment Movement Areas, Ponds or Drainage)	Vertical Modified Uses (Permanent and Temporary/Moveable Improvements)
Farm 1	54.9	3.1	2.6 (84%)	0.5 (16%)
Farm 2	53.0	4.9	4.2 (86%)	0.7 (14%)
Farm 3	96.5	25.0	16.6 (66%)	8.5 (34%)
Farm 4	43.1	5.8	2.2 (38%)	3.6 (62%)
Farm 5	53.4	2.6	1.5 (58%)	1.1 (42%)
Farm 6	115.3	3.4	2.2 (65%)	1.2 (35%)
Farm 7	36.5	3.4	3.1 (91%)	0.3 (9%)
Farm 8	20.0	11.2	7.4 (66%)	3.8 (34%)
Farm 9	51.0	37.6	21.1 (56%)	16.5 (44%)
Farm 10	231.1	136.0	74.6 (55%)	61.4 (45%)

Summary

This study, it is believed for the first time, examines farm “footprints” in New Jersey. The nature, extent, and type of improvements and associated landscape modifications supporting agricultural production were measured and categorized on 10 Case Study Farms through a combination of GIS analysis and site assessments. The study purpose was to provide accurate and sound data to the State Agriculture Development Committee as it seeks to better understand the extent and effects of activities resulting in soil disturbance on productive farmland.

The compilation of such information is an important precursor to the Committee’s effort to interpret deed of easement provisions relating to the permissible type and extent of agricultural improvements on preserved farmland and associated soil disturbance. The timeliness of this research is evident in light of recently evolving state and federal policies seeking to regulate or limit soil disturbance, or minimize water quality impacts, associated with the addition of impermeable surfaces on farm landscapes.

Summary (continued)

Study results demonstrate broad variability in the extent and composition of built infrastructure, and associated landscape modifications, across the 10 Case Study Farms. As noted in Appendix B, New Jersey agriculture is highly diversified in terms of scale of operation, commodity production, ownership structure, and land tenure. The observed variability in the extent and type of landscape modifications was therefore expected. One general conclusion, and cautionary note, is that broad generalizations or inferences about statewide farm landscape modifications cannot be supported by this small sample of Case Study Farms.

Appendix A

Synopsis of Selected State and Federal Policies Governing
Impervious Coverage Limits on Farms

Current Policy Context

Highlands Water Protection and Planning Act

The Highlands Water Protection and Planning Act (2004) designated 860,000 acres, spanning seven counties and 88 municipalities, under a regional growth management plan aimed at protecting drinking water and other environmental and ecological resources. The Act specified a “Preservation Area” comprising 415,000 acres to be under more stringent growth management and environmental protection policies, as well as a 445,000-acre “Planning Area.”

A New Jersey Highlands Water Protection and Planning Council (Council) was formed to develop a regional master plan to guide growth in the Highlands region and protect critical indigenous water, ecological, scenic and historic resources. Among the mechanisms in the plan specified to advance these objectives is the use of impervious cover limits.

Current Policy Context

Highlands Water Protection and Planning Act

Under the Regional Master Plan, any agricultural development in the preservation area that adds 3 percent or more (but less than 9 percent) of new agricultural impervious cover to the farm management unit, will be required to develop and implement a Farm Conservation Plan. Any agricultural development in the preservation area that adds 9 percent or more of new agricultural impervious cover to the farm management unit will be required to develop and implement a Resource Management Systems Plan.

The Regional Master Plan also established a policy directing the Council to work with the State Agriculture Development Committee and Garden State Preservation Trust to create incentives for landowners seeking farmland preservation to limit impervious cover to a maximum of 5 percent of the farm management unit's total land area.

Current Policy Context

Highlands Water Protection and Planning Act

The Highlands Water Protection and Planning Act (N.J.S.A. 13:20-3) defines “impervious surface.”

“Impervious surface” means any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, and includes porous paving, paver blocks, gravel, crushed stone, decks, patios, elevated structures, and other similar structures, surfaces, or improvements.

Distinction is made in the Act of “agricultural impervious cover” as *...agricultural or horticultural buildings, structures, or facilities with or without flooring, residential buildings, and paved areas, but [not] temporary coverings.**

**Temporary coverings are defined in the Act as permeable, woven and non-woven geotextile fabrics that allow for water infiltration or impermeable materials that are in contact with the soil and are used for no more than two consecutive years.*

Current Policy Context

New Jersey Department of Environmental Protection Regulations

The New Jersey Department of Environmental Protection defines “impervious surface” in its stormwater management rules (N.J.A.C. 7:8-1.2).

Impervious surface means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water.

Current Policy Context

2002 Amendments to the Garden State Preservation Trust Act

S-889 (known as the “Smith Bill”) was signed into law in 2002. It amended the Garden State Preservation Trust Act and requires the SADC and New Jersey Department of Environmental Protection to adopt rules establishing standards for regulating improvements on farms preserved by the SADC through its fee simple acquisition or direct easement purchase programs.

“The committee and the Department of Environmental Protection, pursuant to the Administrative Procedure Act, P.L. 1968, c. 410, (C.52:14B-1 et seq.), shall jointly adopt rules and regulations that establish standards and requirements regulating any improvement on lands acquired by the State for farmland preservation purposes using constitutionally dedicated moneys to assure that any improvement does not diminish the protection of surface water or groundwater resources.”

Current Policy Context

Federal Farm and Ranch Lands Protection Program

The State Agriculture Development Committee (SADC) does not impose impervious cover limitations on farms entering farmland preservation, except as a condition for receiving federal funding under the Farm and Ranch Lands Protection Program. When such limits are enacted, it is commonly the case that land preservation transactions are conducted in partnership with conservation groups seeking to minimize future modifications of the farm landscape.

Under current USDA-NRCS rules, farms to be preserved with federal funding cannot have more than 2 percent impervious cover. In certain instances, a waiver from the State Conservationist may increase the impervious cover limit to 10 percent. Impervious cover associated with NRCS-approved conservation projects is not included in the 2 percent limit.

Current Policy Context

Federal Farm and Ranch Lands Protection Program

In the context of FRPP, impervious cover is defined as:

...permanent, non-seasonal rooftops, concrete and asphalt surfaces including residential buildings, agricultural buildings (with and without flooring), and paved areas located on the Premises. Conservation practices listed in the United States Department of Agriculture's Field Office Technical Guide are not considered impervious surface.

Appendix B

Study Limitations

Study Limitations

The use of these findings to make inferences about the nature and extent of landscape modifications at the aggregate farm industry level should be avoided. Results in this study are based upon a deliberate and methodical assessment of infrastructure development and landscape modifications found on ten case study farms. Diversity is a hallmark of New Jersey agriculture; whether defined in terms of size and scale of operation, use of marketing channels, commodity specializations, or land tenure arrangements. Therefore, broad generalizations about the applicability of findings to the overall farm sector cannot be supported.

The research team made every effort to make precise, consistent measurements of landscape features on the farmer-reported Farm Homesteads associated with each case study farm. However, it is acknowledged that several non-quantifiable sources of error may affect both the *accuracy* (how close a measurement is to its actual value) and *precision* (the extent to which repeat measurements produce the same results) of data compiled herein.

Study Limitations

(continued)

The accuracy of measurements, for example, is impacted by factors including the age and resolution of available orthophotography (as well as tree cover, shadows, etc.). Similarly, the precision of measurements is impacted by possible “human error” realized in the process of developing polygon boundaries or misclassification of landscape features based upon visual interpretations of orthophotography. The magnitude of such measurement errors is difficult to quantify without employing costly professional land survey techniques.

To address these potential sources of error, the research team field validated all measurements and landscape classifications to provide best estimates of the actual extent of landscape modifications made to support farming activities.

Appendix C

Farm Case Studies:

Detail on Composition of Core Complexes

Summary of Farm Case Studies

Core Complex Analysis

Case Study	Farm Homestead (acres)	Core Complex (acres)	Modified Uses Subtotal (acres)	Modified Uses Located in Core Complex (acres)	Pct. of Total Modified Uses Located in Core Complex (%)
Farm 1	54.9	4.6	3.1	2.9	93.5
Farm 2	53.0	4.8	4.9	3.2	65.3
Farm 3	96.5	26.2	25.0	19.5	78.0
Farm 4	43.1	10.2	5.8	5.8	100.0
Farm 5	53.4	3.8	2.6	1.9	73.1
Farm 6	115.3	7.7	3.4	3.4	100.0
Farm 7	36.5	1.7	3.4	1.0	29.4
Farm 8	20.0	20.0	11.2	11.2	100.0
Farm 9	51.0	40.6	37.6	37.6	100.0
Farm 10	231.1	159.1	136.0	132.9	97.7

Core Complex - Case Study 1

(Approximately 8.4% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.0	0.0
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	1.6	34.7
Modified Uses	Permanent Improvement– Concrete Floor	0.5	10.2
	Permanent Improvement– Dirt/Gravel Floor	<0.1	0.8
	Temporary/Moveable Improvement	<0.1	0.7
	Equipment Movement Area – Gravel/Paved	2.2	48.8
	Equipment Movement Area – Dirt	0.2	4.8
	Pond or Drainage	0.0	0.0
	Core Complex Total	4.6 acres	100.0%

Core Complex - Case Study 2

(Approximately 9.1% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.1	2.0
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	1.5	31.4
"Modified Uses"	Permanent Improvement– Concrete Floor	0.6	13.0
	Permanent Improvement– Dirt/Gravel Floor	0.1	1.6
	Temporary/Moveable Improvement	<0.1	0.2
	Equipment Movement Area – Gravel/Paved	2.4	48.8
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	0.1	3.0
Core Complex Total		4.8 acres	100.0%

Core Complex - Case Study 3

(Approximately 27.2% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	2.2	8.2
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	4.5	17.2
“Modified Uses”	Permanent Improvement– Concrete Floor	0.7	2.6
	Permanent Improvement– Dirt/Gravel Floor	0.0	0.0
	Temporary/Moveable Improvement	7.4	28.3
	Equipment Movement Area – Gravel/Paved	2.2	8.5
	Equipment Movement Area – Dirt	9.2	35.1
	Pond or Drainage	0.0	0.0
Core Complex Total		26.2 acres	100.0%

Core Complex - Case Study 4

(Approximately 23.7% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.0	0.0
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	4.4	43.2
"Modified Uses"	Permanent Improvement– Concrete Floor	3.5	34.3
	Permanent Improvement– Dirt/Gravel Floor	0.1	1.0
	Temporary/Moveable Improvement	<0.1	0.3
	Equipment Movement Area – Gravel/Paved	2.2	21.2
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	0.0	0.0
Core Complex Total		10.2 acres	100.0%

Core Complex - Case Study 5

(Approximately 7.1% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.0	0.0
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	1.8	46.9
"Modified Uses"	Permanent Improvement– Concrete Floor	0.3	8.7
	Permanent Improvement– Dirt/Gravel Floor	0.7	19.5
	Temporary/Moveable Improvement	<0.1	1.3
	Equipment Movement Area – Gravel/Paved	0.7	17.8
	Equipment Movement Area – Dirt	0.2	5.8
	Pond or Drainage	0.0	0.0
	Core Complex Total	3.8 acres	100.0%

Core Complex - Case Study 6

(Approximately 6.6% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	2.5	32.0
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	1.8	23.6
"Modified Uses"	Permanent Improvement– Concrete Floor	0.9	11.3
	Permanent Improvement– Dirt/Gravel Floor	<0.1	0.1
	Temporary/Moveable Improvement	0.3	3.9
	Equipment Movement Area – Gravel/Paved	2.2	28.9
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	<0.1	0.1
Core Complex Total		7.7 acres	100.0%

Core Complex - Case Study 7

(Approximately 4.6% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.0	0.0
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	0.8	46.73
"Modified Uses"	Permanent Improvement– Concrete Floor	0.1	6.0
	Permanent Improvement– Dirt/Gravel Floor	0.0	0.0
	Temporary/Moveable Improvement	0.2	8.9
	Equipment Movement Area – Gravel/Paved	0.7	38.4
	Equipment Movement Area – Dirt	0.0	0.0
	Pond or Drainage	0.0	0.0
	Core Complex Total	1.7 acres	100.0%

Core Complex - Case Study 8

(100% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	2.1	10.7
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	6.7	33.3
"Modified Uses"	Permanent Improvement– Concrete Floor	0.2	1.2
	Permanent Improvement– Dirt/Gravel Floor	0.0	0.0
	Temporary/Moveable Improvement	3.6	18.0
	Equipment Movement Area – Gravel/Paved	1.3	6.4
	Equipment Movement Area – Dirt	5.7	28.3
	Pond or Drainage	0.4	2.2
Core Complex Total		20.0 acres	100.0%

Core Complex - Case Study 9

(Approximately 79.7% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	0.7	1.7
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	2.3	5.7
"Modified Uses"	Permanent Improvement– Concrete Floor	0.8	2.0
	Permanent Improvement– Dirt/Gravel Floor	0.0	0.0
	Temporary/Moveable Improvement	15.7	38.5
	Equipment Movement Area – Gravel/Paved	1.6	4.1
	Equipment Movement Area – Dirt	19.5	48.1
	Pond or Drainage	0.0	0.0
Core Complex Total		40.6 acres	100.0%

Core Complex - Case Study 10

(Approximately 68.8% of total Farm Homestead)

Landscape Feature		Acres	Pct. of Total Acres
	Production Area – Field, Pasture, Orchard	17.9	11.3
	Appurtenant Land	0.0	0.0
	Lawn or Buffer	8.3	5.2
"Modified Uses"	Permanent Improvement– Concrete Floor	1.4	0.9
	Permanent Improvement– Dirt/Gravel Floor	0.9	0.6
	Temporary/Moveable Improvement	59.1	37.2
	Equipment Movement Area – Gravel/Paved	67.4	42.3
	Equipment Movement Area – Dirt	0.2	0.1
	Pond or Drainage	3.9	2.4
Core Complex Total		159.1 acres	100.0%